

**UNIT I****CLASSICAL MECHANICS**

Generalized co-ordinates – Constraints - D'Alembert principle- Lagrangian equations and its applications - Hamilton's equation from variation principle - Principle of Least action - Canonical Transformation - Poisson Brackets and Lagrange's Brackets - Hamilton - Jacobi equation - Action angle variable Kepler's problem - Theory of small oscillation - Normal modes and frequencies - Linear Triatomic molecule - Rigid body dynamics – Symmetrical Top

**UNIT II****RELATIVITY AND SPACE PHYSICS**

General theory of relativity- Postulates of special theory of Relativity - Lorentz transformation equations and its consequences - Mass - energy relation - Escape velocity and orbital velocity - Geostationary orbit and satellite communication - Remote sensing - Perspective of Geophysics.

**UNIT III****MATHEMATICAL PHYSICS**

Vector analysis - Gauss theorem, Green's theorem - Stoke's theorem and their applications - Matrix - Eigen value and Eigen vector - Trace of Matrix - Cayley - Hamilton theorem - Reduction of Matrix to a diagonal form - Solutions of Linear algebraic equations - Complex variables - Cauchy - Riemann conditions  
- Cauchy's integral theorem - Residues and singularities - Cauchy's Residue theorem - Solution of partial differential equations - Application to heat conduction and wave propagation – Beta – Gamma functions- Special functions - Bessel, Legendre, Hermite and Laguerre differential equations - properties of special functions – Fourier series – Cosine- Sine functions- Applications of Fourier series - Group theory- Space group- Point group – Character table – Reducible and irreducible representations- Schur's lemma- The great orthogonality theorem

## UNIT IV

### ELECTRO MAGNETIC THEORY

Gauss law - Poisson and Laplace equations - Solution of Laplace equation in a Rectangular Box - Molecular polarizability and electrical susceptibility - Maxwell's equations - Poynting's theorem - Vector and scalar potentials - Gauge invariance - Coulomb and Lorentz gauges - Lorentz force - Equation of continuity - The wave equation - Plane waves in a non-conducting medium - Reflection and refraction at a plane interface between dielectrics - Fresnel's law.

## UNIT V

### ELECTRONICS

Semi conductors – Band theory of solids – Transistors – JFET – MOSFET- UJT –SCR – Thyristors – I-V characteristics – applications – Transistor as an Amplifier- RC coupled amplifier – Oscillators – Hartley – Colpits – Phase shift Oscillators – Multivibrators – Astable – Bistable and Monostable - Receivers- Super heterodyne receiver- RADAR- Televisions theory and practice- Antennas – Wave propagation- Mobile communications – Basic Principles

Analog electronics – Operational Amplifiers – Adder- Subtractor- Multiplier- Scale changer – Differentiator-Integrator – Using op amps A/D convertor – D/A convertor – Solving simultaneous equations – Solving Differential equations

## UNIT VI

### THERMODYNAMICS AND STATISTICAL

Mechanics - Laws of thermodynamics - Entropy - thermodynamic potentials - Maxwell's equations and its applications - Gibbs phase rule - Phase transition - Clausius Clapeyron equation - Third law of thermodynamics

Postulates of classical statistical Mechanics - Liouville's theorem - Micro canonical, canonical and grand canonical ensembles - Partition function and entropy of an ideal gas - Gibbs Paradox -Black Body radiation and Planck's Radiation - Phonons - Maxwell's distribution and its application - Postulates of quantum statistics - Bose Einstein and Fermi Dirac Statistics - Applications.

## UNIT VII

### OPTICS, SPECTROSCOPY AND MOLECULAR PHYSICS

Optical activities of Crystals - Colour centers – Kerr effect – Pockel's effect-Linear and Non linear optics Phase matching- Fiber optics- Optical communication ERS and Different types - Principle , theory and applications - Raman Effect and its quantum explanation - Raman Spectroscopy - applications - Kramer and Heisenberg theory - Molecular structure - NMR, ESR, NQR and Mossbauer spectroscopy - theory, techniques and applications - Coupling schemes -Zeeman effect - Paschen - Back effect - spectra and structure of atomic molecules - rotational, vibrational and rotational - Vibrational spectra - Electronic spectra of diatomic molecules - Frank - Condon principle.

## UNIT VIII

### QUANTUM MECHANICS

Postulates - Schrodinger equation Time dependent and time independent - wave function - Hydrogen atom - first order and second order perturbations - Stark effect - WKB quantization rule - Time dependent perturbation theory - Fermi's golden rule - Adiabatic and sudden Approximation - Scattering Cross section - Born Approximation - Relativistic equation – Free particle - Electromagnetic potentials - Energy level in a coulomb field - Dirac's Relativistic equation - Diracs' equation for a central field - spin angular momentum -Negative energy states.

## UNIT IX

### SOLID STATE PHYSICS AND NUCLEAR PHYSICS

Crystal classes and systems – 2D, 3D - Lattices - Liquid crystals - crystal growth- Vibration of monatomic lattices - Phonons - Lattice heat Capacity - Planck distribution - Einstein model - Debye model of the lattice heat capacity - Thermal conductivity - Energy band in metals and insulators - Semi conductor crystals band gap -Tight bound approximation - De Hass - Van Alphen effect. Nuclear mass - Binding energy - Nuclear shell model - Liquid drop model – Yukawa's meson theory - Alpha decay - Fermi's' theory of beeta decay - Nuclear isomerism - Particle detectors - Nuclear fission - Different fusion process - Classification of elementary particles - Isospin quantum numbers - Cosmic rays.

## UNIT X

### DIGITAL ELECTRONICS AND MICROPROCESSOR

Logic gates - DTL, RTL, TTL and ECL - Half and full adders - Half and full subtractors - Parallel binary adder - 8421 adder - Algebraic simplification - Fundamental products - sum of products - AND - OR - Networks - Karnaugh map - NAND - NAND - Networks - Counter techniques RS, RST, JK and master and slave flip flop - ripple counters - parallel counters - BCD counter - shift register - series and parallel register - D/A and A/D conversion. Introduction to microprocessor - architecture of MPU 8085 addressing modes - Instruction type – programming for addition, subtraction and logical operations only - Semi conductor memory types - characteristics RAMs - Reprogrammable ROMs.